REMARKS

Claims 1, 3-5, 7–14, 17, 20, and 21-41 are pending in this application. Claims 1, 21, 31, and 41 are the independent claims.

All Of The Rejections Are Under 35 U.S.C. § 103(a)

The Examiner rejected claims 1, 3, 9-11, 13, 14, 17, 20-22, 27-32, and 37-40 under 35 USC § 103(a) as unpatentable over prior art patent BE 1011263 and either one of the technical note by Zeisler et al. or US patent 6,586,747 to Erdman. The Examiner argues that BE 1011263 discloses a metallic insert with an elongate cavity for holding a target material, but does not teach a different material for one of the insert parts, and that Zeisler and Erdman teach metallic inserts having at least two separate metallic parts of different materials.

The Examiner rejected claims 4, 5, 7, 8, 12, 23-26, 30, and 33-36 as unpatentable over the above references in further view of U.S. 5,917,874 to Schlyer, which discloses coupling by bolts.

For the reasons discussed below, Applicant requests that the pending rejections of claims be withdrawn.

The Problem And Applicants' Solution

As explained in the Background section of the present application, the choice of insert material in irradiation cell target chambers is particularly important. It is necessary to avoid the production of radioisotopes that disintegrate by high-energy gamma particle emission and make any mechanical intervention on the target difficult due to radiosafety problems, while also providing for adequate heat dissipation. In addition, machinability is also an important consideration for the insert material, particularly where the insert is of a complex structure.

Many prior art references disclosing irradiation cells do not utilize an insert (i.e. a separate part comprising the cavity that is introduced into the irradiation cell), but rather comprise several parts assembled together without the ability to easily insert and remove the target chamber and surrounding elements. (Application ¶26). These prior art irradiation cells lack many of the advantages of devices described in the present application and BE '263, which was cited by the Examiner.

The References

BE '263 describes a target chamber, but does not use niobium and discloses only a one piece insert.

BE '263 describes a one piece insert made of silver or titanium, not niobium or tantalum. Although it would be beneficial to use niobium or tantalum for a target chamber insert, niobium and tantalum are difficult to machine and therefore are difficult materials to use for making an insert of complex design, such as the insert described in BE '263. (Application ¶23). For example, a built up edge may occur on the tools used to machine the niobium, leading to high tool wear and/or breakage, and the use of electrical discharge machining is not effective. (Id.). Therefore, one of ordinary skill in the art would not have believed that the complex insert of BE '263 could be made of niobium or tantalum.

The claims of the present application recite an irradiation cell that has a removable insert comprising two insert parts, each of the insert parts being made of different materials. This two-part insert design allows for inserts with longer cavities and improved heat exchange, while allowing the insert to be as chemically inert as possible. Using this two-part design, for instance, a target cavity may have a first part with an overall length of 50mm or greater even when made of difficult to machine materials such as niobium or tantalum. (Application ¶36). A cavity of such increased length has improved heat exchange, and can improve irradiation efficiency with

gaseous targets by providing a longer distance over which target vapor can react with a proton beam. (Application ¶39). Without the two part design of the present application, even a similar device, such as described in BE '263, could not achieve the foregoing advantages.

Further, BE '263 discloses a one-piece insert made of solid silver or titanium. Replacing the one-piece insert of the prior art with a two-part insert comprised of two different materials would not be obvious as argued by the Examiner. The claimed two-part insert surprisingly allows the cavity of the insert to be significantly longer than in the prior art, increasing efficiency and heat exchange properties. (Application ¶39). This is not simply a case of replacing a one-piece device with a two-piece device having identical properties, and therefore the reasons for obviousness argued by the Examiner do not apply in this instance.

There is no suggestion in the art of record that the insert of BE '263 may be made with two distinct parts so that a different material may be used for each part. In fact, although it would be beneficial to use niobium or tantalum for a target chamber insert, niobium is difficult to machine and therefore a difficult material to use for making an insert of complex design, such as the insert described in BE '263. (Application ¶23). A built up edge may occur on the tools used to machine the niobium, leading to high tool wear and/or breakage, and the use of electrical discharge machining is not effective. (Id.). Therefore, one of ordinary skill in the art at the time of the filing of this application would not have believed that the complex insert of BE '263 could be made of niobium or tantalum.

<u>The Zeisler Technical Note Discloses Only A One-Piece Target Chamber Made Of A Single Material (Niobium), And Does Not Suggest Using Two Or More Materials. Therefore, At Most Zeisler Suggests Replacing The Entire Insert Of BE 1011263 With Niobium, Yielding A One-Piece Niobium Insert.</u>

The Examiner argues that it would be obvious to combine BE '263 with a technical note written by Zeisler et al. ("Zeisler"), which discusses the use of niobium to construct a target chamber. However, the structure of Zeisler is substantially different than the structure of BE '263 and other devices, and one of ordinary skill would not have combined structural aspects of Zeisler and the complex insert of BE '263. The device described by Zeisler is shown below:

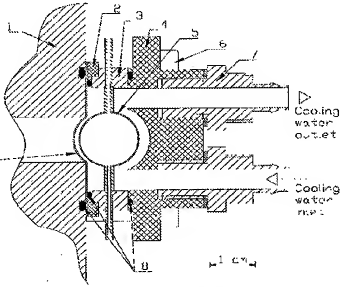

Fig. 2. Simplified technical drawing of the target system. (1) collimator (aluminum); (2) spacer (PEEK®); (3) holder ring (copper); (4) back plate (PEEK®); (5) target chamber (niobium); (6) bolt (SS 316, M 4); (7) fitting (SS 316, 5 mm i.d.); (8) O-rings (Vitón®); (9) vacuum window (aluminum, 0.3 mm thickness).

The target chamber does not include an elongate target cavity machined from niobium, and is instead formed by welding two hemishpheres of niobium to form a spherical cavity. The zeisler target chamber is also does not have a cavity closed by a window, as required by the claims, but instead is fully enclosed by the two niobium hemispheres. At most, one of ordinary skill reading Zeisler would have believed that niobium has beneficial material properties, and would have attempted to manufacture the insert of BE '263 from niobium. However, as discussed above, niobium, tantalum,

and other similar materials are difficult to machine, and one of ordinary skill would not have believed that niobium or tantalum was an appropriate material for manufacturing the complex target chamber insert of BE '263.

Even though Zeisler discloses certain benefits of niobium inserts in target chambers, it does not disclose inserts made of both niobium and another metal such as silver or titanium. The target described is made from two niobium hemispheres and a niobium tube welded together to form a unitary structure. (Zeisler p. 450). The target chamber is shown in Figs. 1 and 2 and is simply referred to as a niobium target chamber. This niobium target chamber is discussed only as a replacement for silver or titanium target chambers, not as being used in combination with silver or titanium target chamber parts. (Zeisler pp. 449, 450). The target chamber is assembled with a copper ring and other components of the irradiation cell so that water may surround the front of the spherical target chamber. (Zeisler p. 450).

The spherical target chamber of Zeisler is substantially different than the insert design of BE '263, and suggests only that niobium is a suitable material for a target chamber. Zeisler does not, for instance, show an elongate target chamber that is longer in the direction of the particle beam. Zeisler does would not suggest to one of ordinary skill in the art machining an elongate target cavity from niobium. Zeisler also does not at all suggest how one would modify the complex structure of the insert of BE '263 in order to utilize the material properties of niobium while also maintaining the beneficial structural features of the '263 insert. Combining the Zeisler article with BE '263 would suggest only replacing a one-piece silver or titanium insert with a niobium insert, but would not suggest to one of ordinary skill in the art a two-part insert made of two different materials.

<u>Erdman 6,586,747 Does Not Disclose A Two-Piece Insert, Does Not Disclose An Insert Made Up Of Two Different Metallic Materials, And Would Not Have Been Combined With BE '263</u>

Erdman '747 does not does not describe an irradiation cell with an insert, but rather describes a series of parts assembled together to form an irradiation cell, as shown below. The target cavity 60 of Erdman is wide and shallow, and disposed at an oblique angle relative to the direction of the proton beam within a holder body 56:

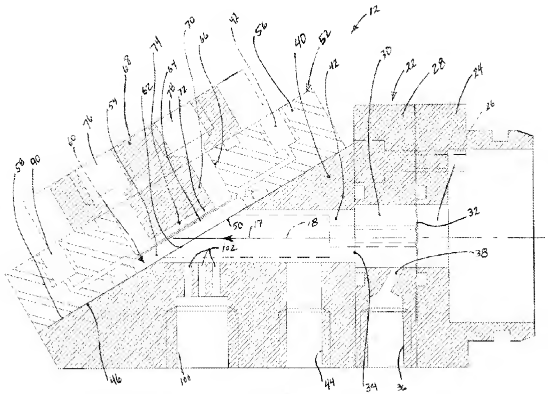

Figure 3

Erdman does not, as the examiner suggest, disclose a first part 64 made of niobium and a second part 56 made of silver. Instead, the holder body 56 and rear window 64 are *integrally formed*. (Erdman col. 5 lns 57-63). The target cavity 60 is machined into one side of the holder body, leaving a thin rear window 64 at the end of the target cavity. (Id.). The holder body 56 of Erdman is of a simpler structure than the insert shown in BE '263, having two simple cavities and an inlet and outlet for the target material. In contrast, the insert of BE '263 includes an elongate target cavity, a cooling channel surrounding the target cavity, and an inlet and outlet for the target material.

As already discussed, the complex structure of the insert shown in BE '263, including the elongate cavity and the cooling channel formed between the portion having the target cavity and an outer portion, would be difficult to machine, and one of ordinary skill at the time of the filing of this application would not have viewed niobium to be a suitable material for the manufacture of such an insert.

Erdman '747 identifies its holder body, which includes the target cavity and rear window, as an alternative to prior art silver target holders that contain impurities and are therefore less advantageous. (Erdman col. 2 lns 41-63; col. 6 lns 14-33). While Erdman acknowledges that other *chemically inert* materials may be used instead of niobium (col. 6 lns 14-33), it specifically teaches away from the use of silver holder bodies. Therefore, Erdman does not disclose the use of a combination of niobium and silver, but rather describes niobium and silver as alternatives to one another.

Furthermore, the structure of the Erdman target cavity is substantially different than that of BE '263 and the structure described in the claims of the present application. Erdman shows a shallow target cavity, and increasing the length of the target cavity is undesirable, as it increases the volume of the target cavity and may therefore become economically undesirable by requiring more initial liquid target material. (Erdman col. 6 lns 61-67). Therefore, one of ordinary skill in the art would not have applied the disclosure of Erdman to irradiation cell designs with longer target cavities, such as BE '263. Advantages afforded by the present application and its two-part design, including longer target cavities than possible with a one-piece niobium insert that allow more efficient irradiation of a vapor target, would not be obvious in view of Erdman's design for irradiation of liquid targets with a shallow target chamber.

<u>The Claims Are Not Obvious-The References Alone Or In Combination Do Not Suggest A Two Piece Insert</u>

As explained above and in the Declaration of Jean-Claude Amelia submitted herewith, none of the cited prior art discloses or suggests a two-part insert, let alone a two-part insert made of two different materials. As the present application indicates, silver and titanium have properties that in some respects are more advantageous than those of niobium in the construction of metallic inserts for target chambers. For instance, silver and titanium are easier to machine than niobium or tantalum and have better thermal conductivity. On the other hand, niobium and tantalum have very low chemical reactivity and are therefore beneficial materials for irradiation targets. Without a two-part insert as claimed herein, the cavity for holding the target material cannot have the overall length and heat exchange properties desired while still having the chemical inertness of niobium or tantalum Therefore, the claimed two-part insert has advantages lacking in both the prior art BE '263 patent and the Zeisler technical note. None of the prior art suggests a two-part insert with the same advantages.

One of ordinary skill in the art would not have modified the insert of BE '263 in view of Zeisler. Zeisler describes a spherical target chamber that is substantially different than the insert design of BE '263 and lacks an elongate target cavity, and suggests only that niobium is a suitable material for a target chamber. Zeisler does not at all suggest how one would modify the complex structure of the insert of BE '263 in order to utilize the material properties of niobium while also maintaining the beneficial structural features of the '263 insert. Combining the Zeisler article with BE '263 would suggest only replacing a one-piece silver or titanium insert with a niobium insert, but would not suggest to one of ordinary skill in the art a two-part insert made of two different materials.

One of ordinary skill in the art would also not have modified the insert of BE '263 in view of the integral holder body and rear window of Erdman '747 that are

made of niobium. The target chamber and rear window of Erdman '747 are machined from a solid block of niobium, and there is no suggestion that the advantages of the present application may be achieved by replacing the one-piece insert of BE '263 with a two-piece insert.

Conclusion

For the foregoing reasons, it is respectfully requested that claims 1, 3-5, 7–14, 17, 20, and 21-41 be allowed to pass to issue.

The Commissioner is hereby authorized to charge any additional fees which may be required with respect to this communication, or credit any overpayment, to Deposit Account No. 06-1135.

Respectfully submitted,

FITCH, EVEN, TABIN & FLANNERY

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